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Factors affecting treatment outcomes of outpatient therapeutic program for treatment of severe acute malnutrition in under-fives: A review

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Abstract
This study aims to scrutinise the factors influencing treatment outcomes in Outpatient Therapeutic Programs (OTPs) targeting Severe Acute Malnutrition (SAM) in children under five. SAM in children under five is a pressing global health issue, necessitating effective treatment to mitigate its high mortality and morbidity risks. OTPs have been pivotal in addressing SAM in resource-constrained settings, offering ready-to-use therapeutic foods (RUTF) and medical care. However, the success of OTPs is dependent upon various factors, including the child's age and nutritional status and the quality of care provided. Understanding these factors and their influence on treatment outcomes is paramount for enhancing OTP effectiveness and alleviating the SAM burden among young children. A thorough search was conducted across Cochrane, Elsevier, and PubMed databases to identify relevant publications between 2016 and 2024. Twenty-four studies were initially retrieved, with thirteen meeting the inclusion criteria for data synthesis. Analysis of the selected studies revealed pivotal factors affecting treatment outcomes in OTPs for SAM. These factors include socio-demographic characteristics, clinical features and caregiver-related factors. Notably, factors such as age, nutritional status, comorbidities, program adherence and caregiver knowledge emerged as significant determinants of treatment success. This review underscores the multifaceted nature of factors influencing treatment outcomes in OTPs for SAM among children under five. Understanding these determinants is crucial for optimising program effectiveness and enhancing child health outcomes in resource-limited settings. Interventions addressing these factors will improve the impact of SAM treatment programs. Further research focusing on tailored interventions is recommended to refine SAM treatment strategies.

Key words: Outpatient-therapeutic-programs, resource-limited-setting, severe-acute malnutrition, treatment-outcomes.

INTRODUCTION

Amidst the global health challenges faced by children under five battling severe acute malnutrition (SAM), understanding the intricate web of factors influencing treatment outcomes in outpatient therapeutic programs (OTPs) is paramount for saving lives and improving health outcomes. Severe Acute malnutrition is a state of nutritional deficiency caused by insufficient consumption of protein or energy (Dipasquale et al., 2020). Primary severe acute malnutrition in children is a prevalent condition in underdeveloped nations due to insufficient food supply resulting from social, economic, and environmental causes. Depending on the degree of malnutrition, a child can either be classified as moderately malnourished or severely malnourished. Statistics from the World Health Organization (WHO) indicate that approximately 19 million children under the age of five suffer from severe acute malnutrition globally, which is estimated to be a major cause of 400,000 child fatalities annually, and most of these children live in south Asia and in sub-Saharan Africa (WHO, 2023) where this study focuses on.

Severe acute malnutrition (SAM) is characterised by a very low weight-for-height/ weight-for-length(< -3 Standard Deviation (SD)), visible severe wasting, clinical symptoms of bilateral pitting oedema or a very low mid-upper arm circumference (< 115 mm) in children aged 6 to 59 months. A complete clinical examination should be conducted on children suffering from severe acute malnutrition in order to determine whether they exhibit any complications.

Previously, all severely malnourished children were managed in the inpatient setting, which greatly limited its coverage and impact. World Food Programme (WFP), The United Nations (UN) and the United Nations International Children's Emergency Fund (UNICEF) issued a joint statement endorsing Community Management of Acute Malnutrition (CMAM), also known in some countries as Integrated Management of Acute Malnutrition (IMAM) guidelines that recommended outpatient care for children with uncomplicated SAM.

There are four components of IMAM guidelines:

Community outreach refers to a variety of initiatives aimed at building community mechanisms for the early identification of wasting and prompt referral of such instances to treatment providers, as well as encouraging community involvement in the program.

Supplemental feeding program (SFP) that is used in the management of moderate acute malnutrition to treat moderate wasting in children aged 6-59 months in an outpatient setup.

Inpatient or stabilisation care is the third component and is used in management of infants and children with SAM that is complicated, i.e. presenting with other underlying medical complications. They are managed in a facility and following the resolution of the medical issues, the child is discharged and continues to receive outpatient care for wasting.

The fourth component and the main focus of this systematic review is treatment for uncomplicated severe wasting, i.e. wasting with no medical complications. It is provided by Outpatient Care (also called Outpatient Therapeutic Program, or OTP) for children aged 6-59 months. Children and infants visit the nearest facilities/health centres for weekly follow-up visits as well as an initial medical evaluation and enrolment in the program.

LITERATURE REVIEW

The outpatient therapeutic program entails Ready-to-Use Therapeutic Food (RUTF) as well as routine drug administration. Some of the routine drugs given include an antibiotic, where the first dose is given at first contact/during enrolment, dewormers, Vitamin A, Folic acid/Iron and Measles vaccine if the child has not been vaccinated before. An appetite test is conducted during the medical examination, and if the child passes the appetite test and the physician is satisfied that the child has no underlying complications, the child is enrolled into the OTP program and given RUTF. RUTF is an energy and protein-dense therapeutic feed given to children between 6-59 months for treatment of malnutrition. The RUTF is rationed by weight, and the stock is replenished after every follow-up visit. It is advised that follow-up visits take place every week, during which the child is reassessed by taking their weight, MUAC, and appetite test, and any rising complication/ medical issues are checked (World Health

Organization. Nutrition for Health and Development, 2013).

Treatment outcomes for OTP include being cured, defaulted, and referred or dead (Al Amad et al., 2017). Patients who miss two follow-up sessions in a row are considered defaulters. A child who has completed their recovery and been released from the Outpatient Therapeutic Program (OTP) is considered cured; a child who was in the OTP program but was later admitted to the hospital due to medical complications is considered referred.

While there are a lot of studies regarding the treatment outcomes of OTP programs, there is a lack of documentation regarding the predictors and factors that affect the treatment outcomes of OTP programs and the duration of recovery for children enrolled in the program. Thus, the purpose of this review is to determine what variables affect SAM treatment outcomes in children receiving outpatient care.

METHODOLOGY

A literature search was conducted employing internet databases, i.e. PubMed, Cochrane and Elsevier, as well as the search engine Google Scholar, to identify relevant articles and studies related to treatment outcomes of outpatient therapeutic programs and factors influencing the outcomes of OTP. Search terms included "outpatient therapeutic programs", "factors influencing treatment outcomes", "treatment outcomes", and "OTP for severe acute malnutrition".

Eligibility Criteria

Inclusion Criteria

Articles that satisfied the following requirements were added to the final analysis after the investigator evaluated the contents of every study that was included.

Study Population

Included were population studies conducted with children under five.

Study Setting

The research carried out in health posts and health centres—areas where OTPs are implemented—were taken into account.

Study Design

Original research that measured treatment outcomes and related variables using cross-sectional and cohort study designs was taken into consideration.

Language

Research done using the English language was taken into consideration.

Publication Criteria

The date of publication was restricted to articles published within the past 7 years, i.e. from 2016 – 2024.

Exclusion Criteria

Excluded studies included systematic reviews, those that were hard to read in full due to missing correspondence from the associated authors, and those that didn't discuss factors influencing the treatment outcomes of OTP.

RESULTS

The initial search on Google Scholar identified 1,970 articles, most of which discussed outpatient therapeutic programs but were not related to severe acute malnutrition. A more specific search on online databases yielded a total of 30 articles, of which 24 articles were obtained based on the relevancy to the search parameters. Further, 11 articles were excluded since they were review articles. The remaining 13 articles were analysed and were used to provide the results of this review, as summarised in Table 1 below:

Table 1: Summary of Results Findings

Study Region	Sample size	Study description	Findings	References
Southern Ethiopia	1048	Cohort study In this cohort study, 1,048 children admitted to 94 OTPs between July to December 2011 in Southern Ethiopia and	Children admitted to OTP programs with oedema had a higher fatality rate than those with non-oedematous SAM.	(Tadesse et al., 2018)

		followed for 14 weeks. Independent anthropometrics and information on treatment outcomes were collected at four home visits.		
Arba Minch Zuria Woreda, Ethiopia	402	Retrospective cohort study From January 1, 2016, to December 31, 2018, institution-based retrospective cohort research was carried out at Arba Minch Zuria Woreda's health posts. Eligible children with SAM were randomly selected from the registration log book. In the health posts, children are followed for a maximum of eight weeks, visiting the facilities weekly for monitoring.	Children < 24 months had longer recovery time than those > 24 months Children identified with oedema upon admission were nearly twice as likely to recover early as those with marasmus. Children with anaemia during registration were less likely to recover from SAM than those without anaemia. Children hospitalised with diarrhoea were 78 per cent less likely to recover from SAM than children who did not have diarrhoea during the admission.	(Gebremedhin et al., 2020)
Nagele Arsi, Ethiopia	357	Retrospective Cohort study An institutional-based retrospective cohort research was carried out among 357 children treated in Nagele Arsi district from July 1, 2018, to June 30, 2020. Simple random sampling was employed to select the children from 20 health posts. Information was obtained from the treatment cards, and SAM treatment outcomes were compared against international SPHERE standards.	Non-oedematous children were less likely to recover from SAM as compared with oedematous children. The rate of time to recovery among new admissions was two times more likely as compared with readmission. Children provided with amoxicillin at admission were more likely to recover compared with those not provided with amoxicillin. Children who received vitamin A were more likely to recover from SAM as compared to their counterparts. Dewormed children were more likely to recover faster compared to those not dewormed. Children with diarrhoea were less likely to recover compared to those without diarrhoea.	(Tsegaye et al., 2022)
Gubalafto Wereda, North Wollo, Ethiopia	600	Retrospective Cohort study From April to May 2019, 600 children were supervised for SAM as part of the OTP. The children were chosen by	Children treated with amoxicillin were 3.38 times more likely to recover than their counterparts. The presence of cough, the presence of diarrhoea, PO	(Abate et al., 2020)

		systematic random selection from nine health stations. A structured questionnaire was used to collect the data.	antibiotics, admission category, and the immunisation status of a child are factors affecting SAM treatment outcome. Children who were completely and partially vaccinated had a recovery rate that was roughly 7 times higher than those who were not vaccinated. Compared to their counterparts, children who received PO antibiotics had nearly 2 times higher chance of recovering from SAM. Newly admitted children had almost four times greater odds of recovery than those who were readmitted.	
Dire Dawa, Eastern Ethiopia	713	Retrospective Cohort study. A facility-based retrospective cohort study coupled with qualitative inquiry (interviews) was conducted in February-March 2017 to analyse the records of 713 children under the age of 5 with SAM, who were selected randomly from four health facilities and one hospital in Dire Dawa.	Low provision of RUTF could cause delayed recovery time in OTP. In this study, those who were dewormed were 1.44 times more likely to recover quickly than those who did not receive them. Plumpy Nuts availability, distance from their home to the health centre, and lack of awareness on how to use Plumpy Nut lead to delayed recovery rates. Sharing of Plumpy Nut at home contributes to delayed recovery from SAM.	(Atnafe et al., 2019)
Karamoja, Uganda	788	Retrospective Cohort study Conducted using a dataset containing records of treatment of children between the age of 6-59 months admitted to nine OTC locations in Karamoja between January 2016 and October 2017. The dataset utilised for this investigation included only children with SAM. Records of treatment were extracted from three outpatient health facilities in three districts.	Wasted children are more likely to have poorer recovery rates than those with oedematous malnutrition. Children aged < 24 months in the study probably had greater severity of acute malnutrition, resulting in poor treatment results.	(Odei Obeng-Amoako et al., 2020)
West Hararghe, Ethiopia	561	Retrospective Cohort study Facility-based retrospective cohort research was conducted in	Children's length of stay on the program for oedematous children was less than wasted children.	(Jima et al., 2023)

		the inpatient unit of two health centres and seven health posts in West Hararghe, Ethiopia, from March to May 2017. The sources of data for the study were individual outpatient therapeutic record cards	Children provided with amoxicillin were more likely to recover compared to their counterparts. Being enrolled with oedema, not taking routine medication (amoxicillin and folic acid) and failing to gain weight in the first 3 weeks were the strongest predictors of a low recovery rate.	
Bench Sheko, South-West Ethiopia	588	Retrospective Cohort study A retrospective cohort study was carried out on 588 children who were handled for SAM under OTP from September 1, 2018, to August 30, 2019, in 4 public health centres in the Bench Sheko zone. Records of all randomly selected eligible children aged 6–59 months who were treated on OTP at selected health institutions the year between September 1, 2018, and August 30, 2019, were analysed.	The rate of recovery from SAM among children who were new admissions was 1.52 times higher than that of children with a history of readmission. The rate of recovery from SAM among children with no history of diarrhoea was 1.9 times higher than those children with a history of diarrhoea. The rates of recovery from SAM among children with no cough were 1.4 times higher than those children with a cough. The rates of recovery from SAM among children who were dewormed were 1.4 times higher than children who had not been dewormed.	(Wondie et al., 2022)
North Gondar zone, Northwest Ethiopia	408	Prospective Follow-up study Facility based prospective follow-up study was carried out from March 24 to May 24, 2017. A total of 408 children with the age of 6–59 months were included in the research. A structured interviewer-administered questionnaire was used. Anthropometric measurements were conducted every week.	Factors that prolong time-to-recovery include diarrhoea and vomiting on admission. In addition, routine medicines like amoxicillin on admission result in a faster recovery time from SAM.	(Mamo et al., 2019)
Wolaita, Southern Ethiopia	794	Retrospective Cross-sectional study A retrospective facility-based cross-sectional research was carried out in OTP records of 794 children treated at 24 health	Factors found as linked with treatment outcome were the distance from OTP to the residence by foot, type of malnutrition, and administration of amoxicillin.	(Kabalo & Seifu, 2017)

		centres retrieved from January to December 2014		
Kabale District, South-western Uganda	637	Retrospective Cross-sectional study All the health centres running the OTC program were purposively selected. A total of 17 health posts were selected to participate in the study. They used all records of children 6–59 months treated under the programme between 2013 – 2015.	It was found that children admitted from the community were 0.3 times less likely to be cured of SAM than those admitted from other health facilities. The number of visits the kid made to the programme to get supplies was favourably linked with the cure of children with severe acute malnutrition.	(Ssekajja et al., 2022)
Shebedido woreda (district), Southern Ethiopia	348	Retrospective Cohort study Retrospective cohort research was carried out using the data of severely acutely malnourished children admitted to 12 of the available health centres in the Shebedino district between January 1, 2011, and January 1, 2013. The research was conducted through a record review of eligible patient cards of children who were treated for SAM in the selected health posts.	Marasmic children stayed longer on treatment compared to children with kwashiorkor. Factors identified as positively affecting the time to recovery were admission weight and the rate of MUAC gain. Alternatively, the age and type of SAM negatively affect the time needed to recover.	(Mengesha et al., 2016)
Eastern province, Zambia	390	Mixed-methods study Records for 390 eligible children hospitalised with SAM between 2008 and 2010 were evaluated. Information on the barriers to the effective implementation of a sustainable OTP intervention was collected through semi-structured interviews with key stakeholders.	Clients defaulted because of stock out of drugs and RUTF, long distances from home to the OTP centre and clients defaulted since the caregivers assumed their children had recovered, even though they had not met the criteria for discharge.	(Mwanza et al., 2016)

DISCUSSION

The results from the table above show some of the factors that influence the treatment outcomes of children enrolled in OTP programs. A compiled and more detailed analysis is discussed below.

Age

The results from the Arba Minch study indicate that the age of the children at admission had a substantial impact on the research participants' recovery times. Children younger than 24 months old required more time to recover from SAM than children older than 24 months. Studies conducted in Karamoja and Shebedido Woreda were in line with this conclusion. The observed differences between children below 24 months and those above 24 months may be the result of a child's need for appropriate nourishment throughout the first 24 months of life, which may necessitate a longer recovery period. Furthermore, infants younger than 24 months old may be more susceptible to infections because of their underdeveloped immunity at the time of admission, which could mean a longer recovery period (Gebremedhin et al., 2020)

Type of Malnutrition

According to research by Tadesse (Tadesse et al., 2018), children who had significant oedema at admission were at a higher risk of dying and of continuing to be very malnourished 14 weeks later. This could be because children with severe oedema should not follow the nutritional management plan with RUTF in an OTP since it provides more protein and energy than the suggested F-75 milk-based diet, which might aggravate the symptoms.

On the other hand, studies from Arba Minch, Karamoja, West Hararghe, Shebedido Woreda, and Wolaita concur that children with oedema at admission had a roughly two-fold higher chance of recovering sooner than those with marasmus.

The rationale offered was that the observed differences between the groups might be explained by the fact that children enrolled by the oedema criteria resolve their oedema easily after OTP, which results in a shorter time to recovery than those children who were admitted with marasmus. (Gebremedhin et al., 2020) Another possible explanation, according to (Jima et al., 2023), is that caregivers and healthcare providers provide relatively better care to oedematous children, as the study shows that caregivers are more concerned about oedematous children than severely wasted children.

The degree of oedema may be the reason for the discrepancy between the Southern Ethiopia report and the other papers. While the other studies do not address severe oedema, Tadesse's study focused exclusively on severe oedema and did not provide any results on moderate oedema.

Presence of Comorbidities

The length of time it took for SAM recovery in this trial was considerably impacted by the existence of anaemia at admission (Gebremedhin et al., 2020). Compared to children without anaemia at enrolment, those with anaemia had a lower chance of recovering from SAM. This may be because, in accordance with the national protocol for the management of SAM, children who were anaemic upon arrival require more time to recover before receiving iron supplements.

Research from Arba Minch, Nagele Arsi, Gubalafto Woreda, Bench Sheko, and North Gondar concur that children who had diarrhoea at the time of admission had a lower chance of recovering from SAM than children who did not have diarrhoea. This association may have as its explanation that children who are malnourished and have diarrheal illness are more likely to lose the intestinal mucosal barrier, which leads to systemic immunosuppression. As a result, these children require longer times to recover than children who are admitted but do not have diarrhoea. (Tsegaye et al., 2022).

Children without coughs recovered from OTP at rates 1.4 times greater than those with coughs, according to the Bench Sheko study. The reason for this, according to the Gubalafto Woreda study, is that due to appetite loss and the likelihood that they would vomit while coughing, children with coughs may not consume the appropriate amount of RUTF (plumpy nut) required per day, thus increasing the chance of poor outcomes.

Type of Admission

Findings from the study in Gubalafto Woreda show that new admissions had approximately 4 times higher odds of recovery compared to those who were readmitted. This could be explained as new admissions are not likely to have medical complications, whereas children who have been readmitted may come with more complications or latent infections, which ultimately decreases the recovery rate. (Abate et al., 2020) This is further supported by studies in Nagele Arsi and Bench Sheko.

Administration of Routine Medications

The North Gondar study found that children who received amoxicillin as part of their regular treatment regimen at the time of admission recovered more quickly than those who did not (Mamo et al., 2019). This could be explained by the fact that PO antibiotics, like amoxicillin, address asymptomatic infections that limit the effectiveness of SAM treatment and speed up recovery. This conclusion was also supported by studies conducted in Nagele Arsi, Gubalafto Woreda, West Hararghe and Wolaita.

The Nagele Arsi study found that children who had vitamin A had a higher chance of recovering from SAM than those who did not. It is the only study that brought up vitamin A as a regular prescription that had a big impact on the patients' treatment results. The rationale is that vitamin A is necessary for immune system

maintenance and the integrity of the body's epithelial cells. As a result, vitamin A is crucial for preventing infections as well as the chance of disease and mortality from infections in children (Tsegaye et al., 2022).

Consistent with the results of the research undertaken in Nagele Arsi and Bench Sheko, the Dire Dawa study indicated that individuals who received deworming treatments were 1.44 times more likely to recover faster than those who did not. This could be because deworming children on a regular basis may enhance their appetite and improve their nutritional absorption since children with SAM are more likely to become infected. Helminthic infections typically result in anaemia, which can further delay recovery and loss of appetite owing to stomach distention (Wondie et al., 2022).

Immunisation Status

Results from the Gubalafto Woreda study indicate that children who had both complete and partial vaccinations recovered at a rate that was around seven times higher than that of children who did not receive any vaccinations. The most likely explanation for this is that vaccination boosts and primes the immune system, making it better able to fight off or avoid diseases that could impede healing (Abate et al., 2020).

Availability of RUTF

Poor treatment outcomes for SAM children receiving OTP are caused by service providers' inadequate provision of RUTF, according to the Dire Dawa study. It also revealed that one major factor in the delayed recovery from SAM is the sharing of Plumpy Nut among family members. This is consistent with the Zambian study, which suggests that a primary cause of poor treatment results is supply issues, or running out of supplies (Mwanza et al., 2016).

The article further documents that some caregivers sell RUTFs in stores, and giving RUTFs to healthy kids at home could postpone the nutritional recovery of SAM kids and result in long-term nutritional deprivation for the children.

Distance to OTP Centres

Children who lived fewer than 25 minutes away from the health centres had a 1.53 times higher chance of recovering than those who lived more than 25 minutes away, according to the Wolaita study (Kabalo & Seifu, 2017).

The study's findings may be explained by the fact that kids who live farther away from OTP are less likely than those who live closer to the site to routinely attend OTP facilities. This is corroborated by research conducted in Kabale (Ssekajja et al., 2022), which found a favourable correlation between the number of times a kid visited the program to obtain supplies and the recovery of children from severe acute malnutrition. This is due to the fact that individuals with greater attendance rates were more likely to follow the treatment plan, which allowed the children to recover.

CONCLUSION AND RECOMMENDATION

Conclusion: It is evident from this analysis that children engaged in OTP programs have different treatment results depending on both controllable and non-modifiable characteristics. Age, the kind of malnutrition, and the type of admission are examples of non-modifiable variables. The rest of the modifiable factors need immediate intervention to ensure the timely recovery of SAM children.

Recommendations: In order to ensure that all children enrolled in OTP programs have a fair chance at recovery, it is imperative that RUTF supplies be kept well-stocked to prevent shortages; additionally, caregivers should be provided with appropriate nutrition counselling and advised against sharing RUTF with stable children, as this will lessen the likelihood of the ill child's recovery. Patients with comorbidities should also receive the necessary care prior to enrolment in OTP programs.

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